

**FINAL REPORT
MAY 2007**

REPORT NO. 07-04



**TRANSPORTABILITY TESTING OF THE
FAMILY OF MEDIUM TACTICAL VEHICLES (FMTV)
10-TON DUMP TRUCK,
TP-94-01, "TRANSPORTABILITY TESTING PROCEDURES"**

Prepared for:

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**TRANSPORTABILITY TESTING OF THE
FAMILY OF MEDIUM TACTICAL VEHICLES (FMTV) 10-TON DUMP TRUCK,
TP-94-01, REV. 2, JUNE 2004, "TRANSPORTABILITY TESTING
PROCEDURES"**

ABSTRACT

The U.S. Army Defense Ammunition Center (DAC), Validation Engineering Division (SJMAG-DEV), was tasked by the Product Manager-Medium Tactical Vehicles to conduct transportability testing on the Family of Medium Tactical Vehicles (FMTV) 10-ton dump truck manufactured by Stewart and Stevenson Systems, Inc., Sealy, Texas. The testing was conducted in accordance with TP-94-01, Revision 2, June 2004 "Transportability Testing Procedures."

The objective of the testing was to evaluate the FMTV 10-ton dump truck when transportability tested in accordance with TP-94-01, Revision 2, June 2004.

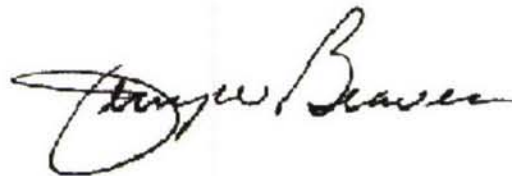
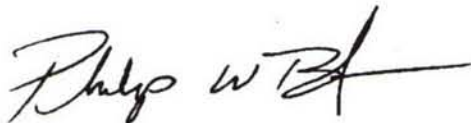
The following observations resulted from the testing FMTV 10-ton dump truck:

1. Web straps could not be used to secure the payload in place. The vehicle did not have provisions to accept the hook on the strap. For example, the diameter of the steel bar that runs along the entire length of the exterior of the dump bed was too large to properly engage the hooks.
2. Steel banding had to be used to secure the payload. The steel banding was secured to the steel bar.

No damage occurred to the steel bar or the vehicle as a result of transporting the payload. Therefore, the FMTV 10-ton dump truck is adequate for transport of ammunition when properly secured using steel strapping.

Prepared by:

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REPORT NO. 07-04

**Transportability Testing of the
Family of Medium Tactical Vehicles (FMTV) 10-Ton Dump Truck
TP-94-01, Revision 2, June 2004 "Transportability Testing Procedures"**

TABLE OF CONTENTS

PART	PAGE NO.
1. INTRODUCTION	1-1
A. BACKGROUND	1-1
B. AUTHORITY	1-1
C. OBJECTIVE	1-1
D. OBSERVATIONS	1-1
E. CONCLUSIONS	1-3
2. ATTENDEES	2-1
3. TEST EQUIPMENT	3-1
4. TEST PROCEDURES	4-1
A. RAIL TEST	4-1
B. ON/OFF ROAD TESTS	4-3
1. HAZARD COURSE	4-3
2. ROAD TRIP	4-4
3. PANIC STOPS	4-4
4. WASHBOARD COURSE	4-4
C. OCEAN-GOING VESSEL TEST	4-4
5. TEST RESULTS	5-1
5.1 TESTING DATE -28 March 2007	5-1
A. ON/OFF ROAD TESTS	5-2
1. HAZARD COURSE	5-2
2. ROAD TRIP	5-3
3. PANIC STOPS	5-3
4. HAZARD COURSE	5-3
5. WASHBOARD COURSE	5-4
B. CONCLUSION	5-4
6. DRAWINGS	6-1

PART 1 – INTRODUCTION

A. BACKGROUND. The U.S. Army Defense Ammunition Center (DAC), Validation Engineering Division (SJMAC-DEV), was tasked by the Product Manager-Medium Tactical Vehicles to conduct transportability testing on the Family of Medium Tactical Vehicles (FMTV) 10-ton dump truck manufactured by Stewart and Stevenson Systems, Inc., Sealy, Texas. The testing was conducted in accordance with TP-94-01, Revision 2, June 2004 "Transportability Testing Procedures."

B. AUTHORITY. This test was conducted IAW mission responsibilities delegated by the U.S. Army Joint Munitions Command (JMC), Rock Island, IL. Reference is made to the following:

1. AR 740-1, 15 June 2001, Storage and Supply Activity Operation.
2. OSC-R, 10-23, Mission and Major Functions of U.S. Army Defense Ammunition Center (DAC) 21 Nov 2000.

C. OBJECTIVE. The objective of the testing was to evaluate the FMTV 10-ton dump truck when transportability tested in accordance with TP-94-01, Revision 2, June 2004.

D. OBSERVATIONS. The following observations resulted from the testing FMTV 10-ton dump truck:

1. Web straps could not be used to secure the payload in place. The vehicle did not have provisions to accept the hook on the strap. For example, the diameter of the steel bar that runs along the entire length of the exterior of the dump bed was too large to properly engage the hooks.
2. Steel banding had to be used to secure the payload. The steel banding was secured to the steel bar.

E. CONCLUSION. No damage occurred to the steel bar or the vehicle as a result of transporting the payload. Therefore, the FMTV 10-ton dump truck is adequate for transport of ammunition when properly secured using steel strapping.

PART 2 - ATTENDEES

ATTENDEE

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PART 3 - TEST EQUIPMENT

Family of Medium Tactical Vehicles 10-Ton Dump Truck

Manufactured by Stewart and Stevenson Systems, Inc.

Serial Number: DX-104945AGFS

Date of Manufacture: 06/06

Tare Weight: 26,580 pounds

PART 4 - TEST PROCEDURES

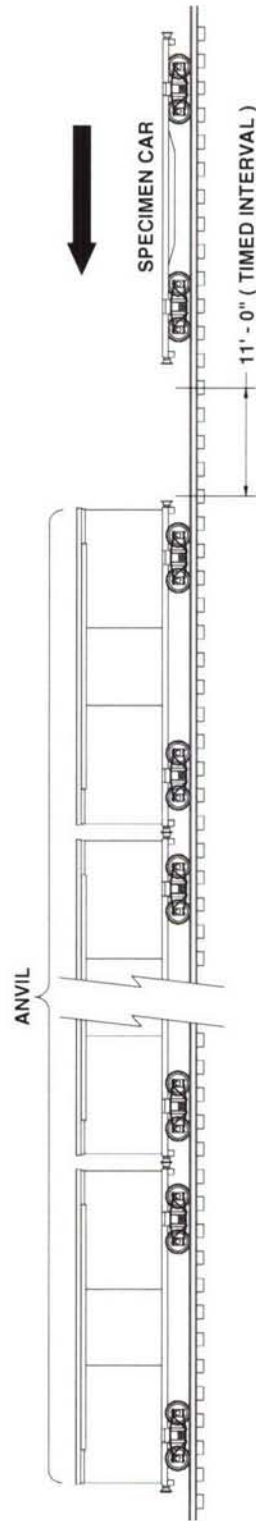
The test procedures outlined in this section were extracted from TP-94-01, "Transportability Testing Procedures," Revision 2, June 2004, for validating tactical vehicles and outloading procedures used for shipping munitions by tactical truck, railcar, and ocean-going vessel.

The rail impact will be conducted with the loaded intermodal container secured directly to the railcar. Inert (non-explosive) items were used to build the load. The test loads were prepared using the blocking and bracing procedures proposed for use with munitions (**see Part 6 for procedures**). The weight and physical characteristics (weights, physical dimensions, center of gravity, etc.) of the test loads were similar to live (explosive) ammunition.

A. RAIL TEST. RAIL IMPACT TEST METHOD. The test load or vehicle will be secured to a flatcar. The equipment needed to perform the test will include the specimen (hammer) car, four empty railroad cars connected together to serve as the anvil, and a railroad locomotive. The anvil cars will be positioned on a level section of track with air and hand brakes set and with draft gears compressed. The locomotive unit will push the specimen car toward the anvil at a predetermined speed, then disconnect from the specimen car approximately 50 yards away from the anvil cars allowing the specimen car to roll freely along the track until it strikes the anvil. This will constitute an impact. Impacting will be accomplished at speeds of 4, 6, and 8.1 mph in one direction and at a speed of 8.1 mph in the reverse direction. The tolerance for the speeds is plus 0.5 mph, minus 0.5 mph for the 4 mph and 6 mph impacts, and plus 0.5 mph, minus 0 mph for the 8.1 mph impacts. The impact speeds will be determined by using an electronic counter to measure the time for the specimen car to traverse an 11-foot distance immediately prior to contact with the anvil cars (see Figure 1).

ASSOCIATION OF AMERICAN RAILROADS (AAR)

STANDARD TEST PLAN



4 BUFFER CARS (ANVIL)
WITH DRAFT GEAR
COMPRESSED AND AIR BRAKES IN A SET
POSITION

ANVIL CAR TOTAL WT. 250,000 LBS (APPROX)

SPECIMEN CAR IS RELEASED BY SWITCH ENGINE
TO

ATTAIN: IMPACT NO. 1 @ 4 MPH

IMPACT NO. 2 @ 6 MPH

IMPACT NO. 3 @ 8.1 MPH

THEN THE CAR IS REVERSED AND RELEASED BY
SWITCH ENGINE TO ATTAIN:

IMPACT NO. 4 @ 8.1 MPH

Figure 1. Rail Impact Sketch

B. ON/OFF ROAD TEST.

1. HAZARD COURSE. The test load or vehicle will be transported over the 200-foot-long segment of concrete-paved road consisting of two series of railroad ties projecting 6 inches above the level of the road surface. The hazard course will be traversed two times (see Figure 2).

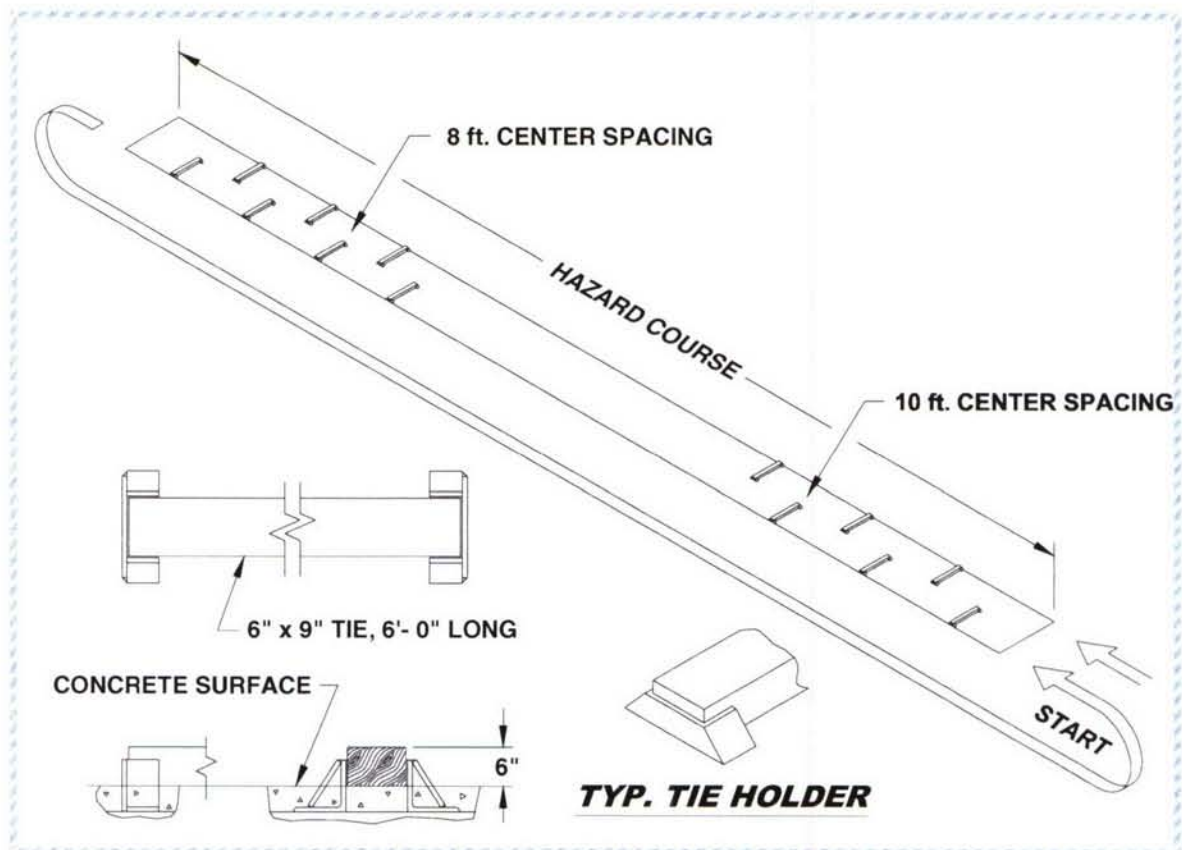


Figure 2. Hazard Course Sketch

- a. The first series of 6 ties are spaced on 10-foot centers and alternately positioned on opposite sides of the road centerline for a distance of 50 feet.
- b. Following the first series of ties, a paved roadway of 75 feet separates the first and second series of railroad ties.

c. The second series of 7 ties are spaced on 8-foot centers and alternately positioned on opposite sides of the road centerline for a distance of 48 feet.

d. The test load is driven across the hazard course at speeds that will produce the most violent vertical and side-to-side rolling reaction obtainable in traversing the hazard course (approximately 5 mph).

2. ROAD TRIP. The test load or vehicle will be transported for a distance of 30 miles over a combination of roads surfaced with gravel, concrete, and asphalt. The test route will include curves, corners, railroad crossings and stops and starts. The test load or vehicle will travel at the maximum speed for the particular road being traversed, except as limited by legal restrictions.

3. PANIC STOPS. During the road trip, the test load or vehicle will be subjected to three (3) full airbrake stops while traveling in the forward direction and one in the reverse direction while traveling down a 7 percent grade. The first three stops are at 5, 10, and 15 mph while the stop in the reverse direction is approximately 5 mph. This testing will not be required if the Rail Impact Test is performed.

4. WASHBOARD COURSE. The test load or vehicle will be driven over the washboard course at a speed that produces the most violent response in the vertical direction.

C. OCEAN-GOING VESSEL TEST. Shipboard Transportation Simulator (Test Method 5). The Shipboard Transportation Simulator (STS) is used for testing loads in 8-foot-wide by 20-foot-long intermodal freight containers. The specimen shall be positioned onto the STS and securely locked in place using the cam lock at each corner. Using the procedure detailed in the operating instructions, the STS shall begin oscillating at an angle of 30 degrees, plus or minus 2 degrees, either side of vertical center and a frequency of 2 cycles-per-

minute (30 seconds, plus or minus 2 seconds) for a duration of two (2) hours. This frequency shall be observed for apparent defects that could cause a safety hazard. The frequency of oscillation shall then be increased to 4 cycles-per-minute (15 seconds, plus or minus one second per cycle) and the apparatus operated for two (2) hours. If an inspection of the load does not indicate an impending failure, the frequency of oscillation shall be further increased to 5 cycles-per-minute (12 seconds, plus or minus one second per cycle), and the apparatus operated for four (4) hours. The operation does not necessarily have to be continuous; however, no changes or adjustments to the load or load restraints shall be permitted at any time during the test. After once being set in place, the test load (specimen) shall not be removed from the apparatus until the test has been completed or is terminated.

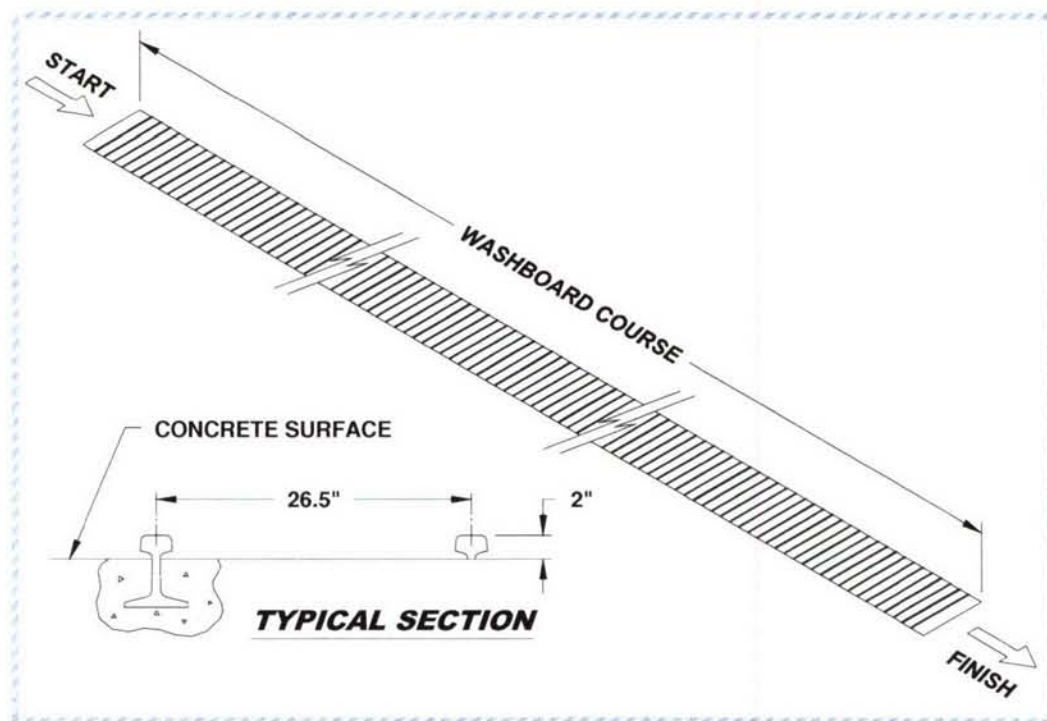


Figure 3. Washboard Course Sketch

PART 5 - TEST RESULTS

5.1

Test Specimen: Family of Medium Tactical Vehicles 10-Ton Dump Truck

Payload: Pallets of C445 Boxes and Small Arms Boxes.

Testing Date: 28 March 2007

Gross Weight: 40,800 pounds (Including truck, pallets and dunnage).

Payload Weight: 14,220 pounds.

Notes:

1. Web straps could not be used to secure the payload in place. The diameter of the bar along each side of the truck was too large for the web strap hook to properly engage.
2. Steel banding had to be used to secure the payload. The steel banding was secured to the steel bar.



Photo 1. Payload Secured in Dump Truck



Photo 2. Steel Banding Secured to the Tie-down Bar

A. ON/OFF ROAD TESTS.

1. HAZARD COURSE.



Photo 3. 10-Ton Dump Truck on the Hazard Course

Pass No.	Elapsed Time	Avg. Velocity (mph)
1	22 Seconds	6
2	23 Seconds	6

Figure 4.

Remarks:

1. Figure 4 lists the average speeds of the test load through the Hazard Course.
2. Inspection following Passes #1 & #2 did not reveal any damage to the vehicle, payload, steel strapping or tie-down bar.

2. ROAD TRIP:

Remarks:

1. The Road Trip was conducted between the Road Hazard Course Passes #2 and #3.
2. Inspection following the Road Trip revealed no damage to the vehicle, payload, steel strapping or tie-down bar.

3. PANIC STOPS: Inspection following completion of each of the Panic Stops did not reveal any damage to the vehicle, payload, steel strapping or tie-down bar.

4. HAZARD COURSE:

Pass No.	Elapsed Time	Avg. Velocity (mph)
3	23 Seconds	6
4	20 Seconds	7

Figure 5.

Remarks:

1. Figure 5 lists the average speeds of the test load through the Hazard Course.

2. Inspection following Passes 3 & 4 did not reveal any damage to the vehicle, payload, steel strapping or tie-down bar.

5. WASHBOARD COURSE:

Remark: Inspection following the Washboard Course did not reveal any damage to the vehicle, payload, steel strapping or tie-down bar.



Photo 4. 10-Ton Dump Truck on the Washboard Course

B. CONCLUSIONS:

1. No damage occurred to the steel bar on the 10-ton dump truck as a result of transporting the payload. Also, no damage occurred to the vehicle, payload or steel strapping as result of the testing.

2. As tested, the 10-ton dump truck is adequate for the transport of ammunition when the payload is properly secured using steel banding.

PART 6 – DRAWINGS

The following drawing represents the load configuration that was subjected to the test criteria.

TEST SKETCH

LOADING, BRACING, AND TIEDOWN PROCEDURES FOR AMMUNITION ITEMS LOADED ON MODEL XM1157 TEN TON DUMP TRUCK

NOTE: THE AMMUNITION TIEDOWN PROCEDURES CONTAINED WITHIN THIS DOCUMENT ARE TYPICAL. THE DEPICTED ITEMS ARE REPRESENTATIVE OF THE VARIOUS TYPES OF AMMUNITION THAT MAY BE RESTRAINED AND TRANSPORTED ON THE MODEL XM1157 TEN TON DUMP TRUCK. THESE PROCEDURES WERE USED IN SUPPORT OF THE TRANSPORTABILITY TEST CONDUCTED IN MARCH OF 2007 AT THE DEFENSE AMMUNITION CENTER, MCALESTER, OK.

Prepared during March 2007 by:
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GENERAL NOTES

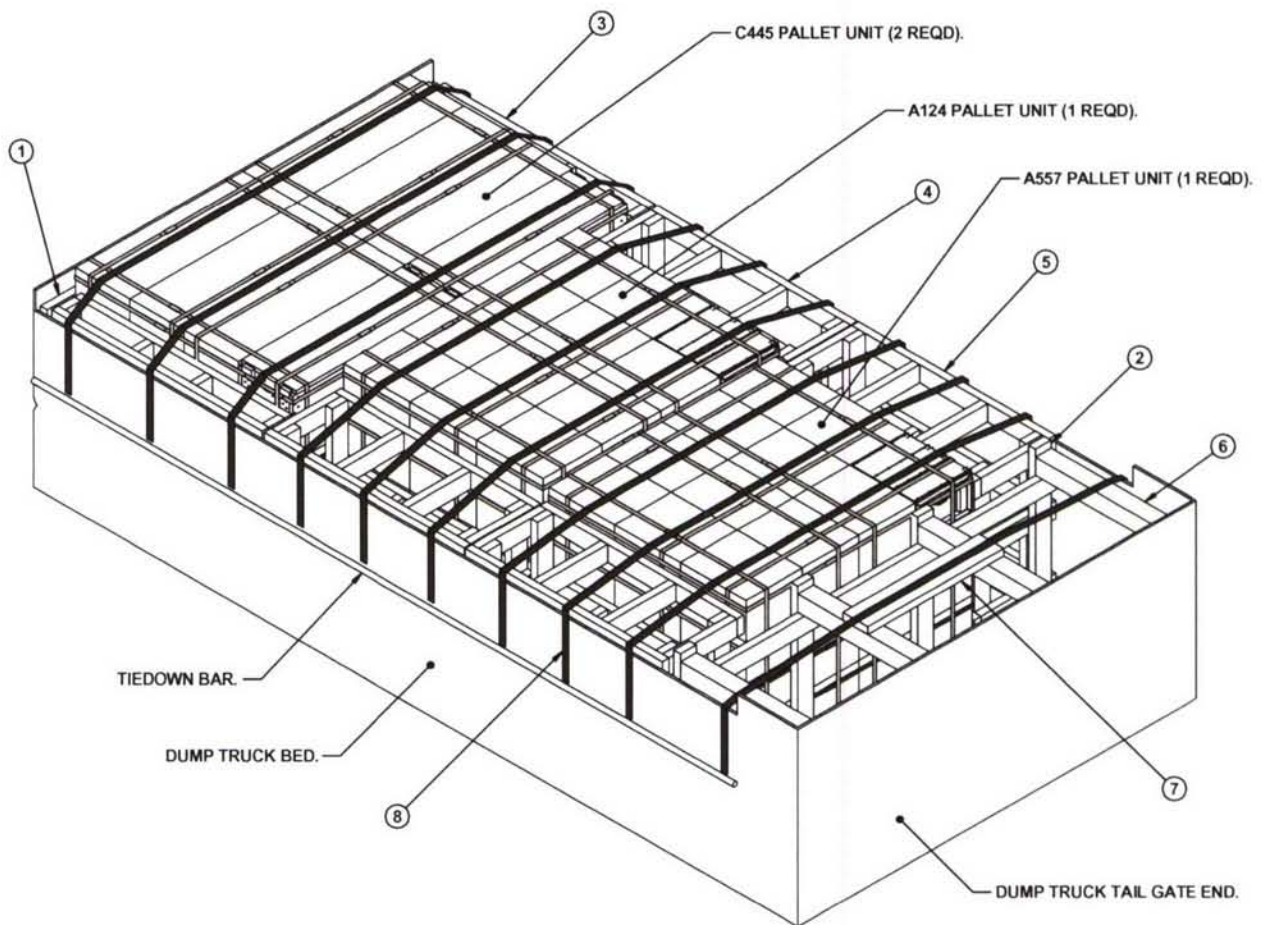
- A. WHEN STEEL STRAPPING IS SEALED AT AN END-OVER-END LAP JOINT, A MINIMUM OF ONE SEAL WITH TWO PAIR OF NOTCHES WILL BE USED TO SEAL THE JOINT WHEN A NOTCH-TYPE SEALER IS BEING USED. A MINIMUM OF TWO SEALS, BUTTED TOGETHER WITH TWO PAIR OF CRIMPS PER SEAL WILL BE USED TO SEAL THE JOINT WHEN A CRIMP-TYPE SEALER IS BEING USED.
- B. WHEN LOADING CONTAINERS, THEY ARE TO BE POSITIONED SO AS TO ACHIEVE A TIGHT LOAD (TIGHT AGAINST THE DUNNAGE ASSEMBLIES). THE UNBLOCKED SPACE ACROSS THE WIDTH OF A LOAD BAY IS NOT TO EXCEED 1-1/2". EXCESSIVE SLACK CAN BE ELIMINATED FROM A LOAD BY LAMINATING ADDITIONAL PIECES OF APPROPRIATE THICKNESS TO THE HORIZONTAL PIECES ON THE SIDE BLOCKING ASSEMBLIES. NAIL EACH ADDITIONAL PIECE W/1 APPROPRIATELY SIZED NAIL EVERY 12". ADDITIONALLY, THE THICKNESS AND/OR QUANTITY OF THE VERTICAL OR HORIZONTAL PIECES IN THE SIDE BLOCKING ASSEMBLIES MAY BE ADJUSTED AS REQUIRED TO FACILITATE VARIANCE IN THE SIZE OF THE CONTAINERS.
- C. DUNNAGE LUMBER SPECIFIED IS OF NOMINAL SIZE. FOR EXAMPLE, 1" X 4" MATERIAL IS ACTUALLY 3/4" THICK BY 3-1/2" WIDE AND 2" X 6" MATERIAL IS ACTUALLY 1-1/2" THICK BY 5-1/2" WIDE.
- D. A STAGGERED NAILING PATTERN WILL BE USED WHENEVER POSSIBLE WHEN NAILS ARE DRIVEN INTO JOINTS OF DUNNAGE ASSEMBLIES OR WHEN LAMINATING DUNNAGE. ADDITIONALLY, THE NAILING PATTERN FOR AN UPPER PIECE OF LAMINATED DUNNAGE WILL BE ADJUSTED AS REQUIRED SO THAT A NAIL FOR THAT PIECE WILL NOT BE DRIVEN THROUGH, ON TO, OR RIGHT BESIDE A NAIL IN A LOWER PIECE.

E. RECOMMENDED SEQUENTIAL LOADING PROCEDURES:

1. PREFABRICATE FORWARD BLOCKING ASSEMBLY, TWO REAR BLOCKING ASSEMBLIES, TWO C445 SIDE BLOCKING ASSEMBLIES, TWO A124 SIDE BLOCKING ASSEMBLIES, AND TWO A557 SIDE BLOCKING ASSEMBLIES.
2. INSTALL THE FORWARD BLOCKING ASSEMBLY AGAINST THE BACK WALL OF THE DUMP TRUCK BED.
3. LOAD TWO C445 PALLET UNITS TIGHT AND CENTERED AGAINST FORWARD BLOCKING ASSEMBLY.
4. INSTALL EACH C445 SIDE BLOCKING ASSEMBLY BETWEEN EACH SIDE OF THE C445 PALLET UNITS AND THE DUMP TRUCK BED SIDE WALL.
5. LOAD A124 PALLET UNIT TIGHT AND CENTERED AGAINST C445 PALLET UNITS.
6. INSTALL EACH A124 SIDE BLOCKING ASSEMBLY BETWEEN EACH SIDE OF THE A124 PALLET UNIT AND THE DUMP TRUCK BED SIDE WALL.
7. LOAD A557 PALLET UNIT TIGHT AND CENTERED AGAINST A124 PALLET UNIT.
8. INSTALL EACH A557 SIDE BLOCKING ASSEMBLY BETWEEN EACH SIDE OF THE A557 PALLET UNIT AND THE DUMP TRUCK BED SIDE WALL.
9. INSTALL BOTH REAR BLOCKING ASSEMBLIES AFT OF THE A557 PALLET UNIT, WITH STRUT LEDGERS FACING EACH OTHER.
10. INSTALL THE STRUTS TO CREATE A TIGHT LOAD.
11. INSTALL STRAPPING BOARD AND 1-1/4" STEEL STRAP OVER REAR 4 X 4 STRUTS.
12. INSTALL NINE 1-1/4" STEEL STRAPS OVER THE PALLET UNITS.

MATERIAL SPECIFICATIONS

- LUMBER - - - - - : SEE TM 743-200-1 (DUNNAGE LUMBER) AND VOLUNTARY PRODUCT STANDARD PS 20.
- NAILS - - - - - : ASTM F1667; COMMON STEEL NAIL NLCMS OR NLCMMS).
- STRAPPING, STEEL - - - : ASTM D3953; FLAT STRAPPING, TYPE 1, HEAVY DUTY, FINISH A, B (GRADE 2), OR C.
- SEAL, STRAP - - - - : ASTM D3953; CLASS H, FINISH A, B (GRADE 2), OR C, DOUBLE NOTCH TYPE, STYLE I, II, OR IV.
- WIRE, CARBON STEEL - - : ASTM A853; ANNEALED AT FINISH, BLACK OXIDE FINISH, 0.0800" DIA, GRADE 1006 OR BETTER.



ISOMETRIC VIEW

KEY NUMBERS

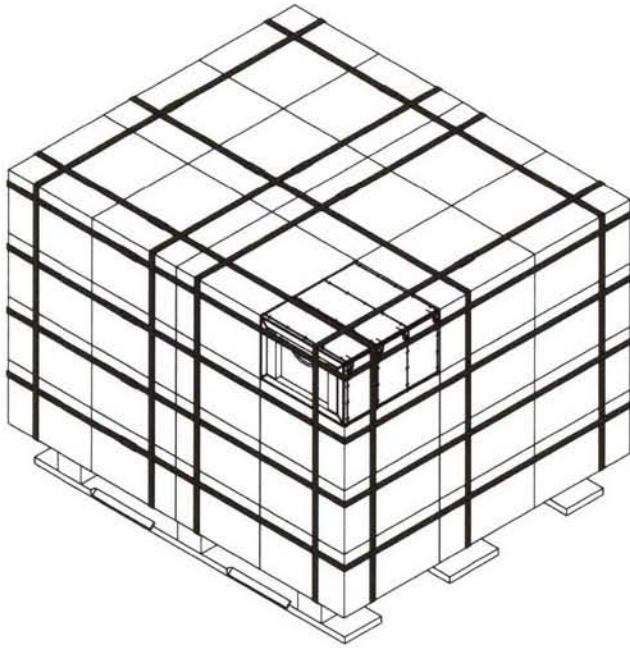
- ① FORWARD BLOCKING ASSEMBLY (1 REQD). SEE DETAIL ON PAGE 5.
- ② REAR BLOCKING ASSEMBLY (2 REQD). SEE DETAIL ON PAGE 6.
- ③ C445 SIDE BLOCKING ASSEMBLY (2 REQD). SEE DETAIL ON PAGE 7.
- ④ A124 SIDE BLOCKING ASSEMBLY (2 REQD). SEE DETAIL ON PAGE 8.
- ⑤ A557 SIDE BLOCKING ASSEMBLY (2 REQD). SEE DETAIL ON PAGE 9.
- ⑥ STRUT, 4" X 4" BY CUT-TO-FIT (REF: 27") (8 REQD), TOENAIL TO REAR BLOCKING ASSEMBLY W/2-12d NAILS AT EACH END.
- ⑦ STRAPPING BOARD, 2" X 6" X 30" (1 REQD), NAIL TO STRUTS W/2-10d NAILS AT EACH JOINT.
- ⑧ HOLD-DOWN STRAP, 1-1/4" X .050" OR .044" X 12'-0" LONG STEEL STRAPPING (10 REQD), INSTALL 3 STRAPS OVER EACH ROW OF PALLET UNITS AND 1 STRAP OVER STRAPPING BOARD OF REAR BLOCKING ASSEMBLY. ATTACH EACH END TO THE TIEDOWN BARS ALONG THE SIDES OF THE DUMP TRUCK BED.

BILL OF MATERIAL

LUMBER	LINEAR FEET	BOARD FEET
2" X 4"	341	227
2" X 6"	3	3
4" X 4"	18	24
NAILS	NO. REQD	POUNDS
10d (3")	436	6-3/4
12d (3-1/4")	32	1/2
1-1/4" WIDE STEEL STRAP - - 10 REQD - - 18 LBS		

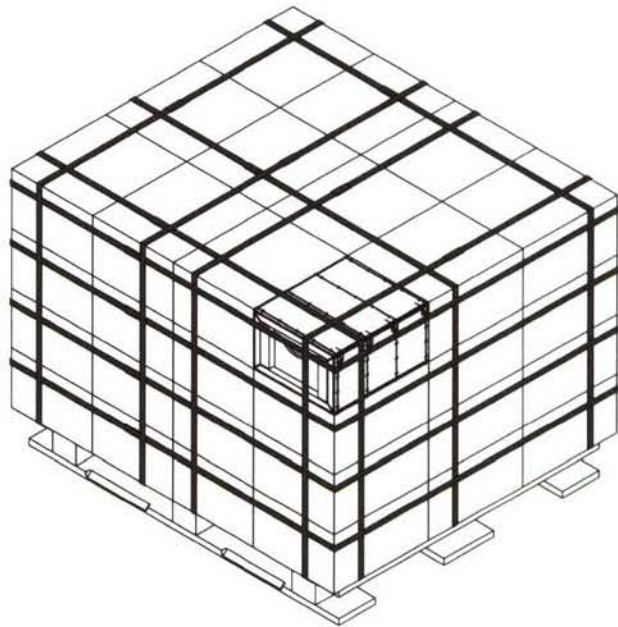
LOAD AS SHOWN

ITEM	QUANTITY	WEIGHT (APPROX)
C445 PALLET UNIT - - - - -	2 - - - - -	4,560 LBS
A124 PALLET UNIT - - - - -	1 - - - - -	3,935 LBS
A557 PALLET UNIT - - - - -	1 - - - - -	3,791 LBS
DUNNAGE - - - - -	- - - - -	533 LBS
TOTAL WEIGHT - - - - -		12,819 LBS



A124 PALLET UNIT

GROSS WEIGHT - - - - - 3,935 LBS (APPROX)
 CUBE - - - - - 52.6 CU FT (APPROX)



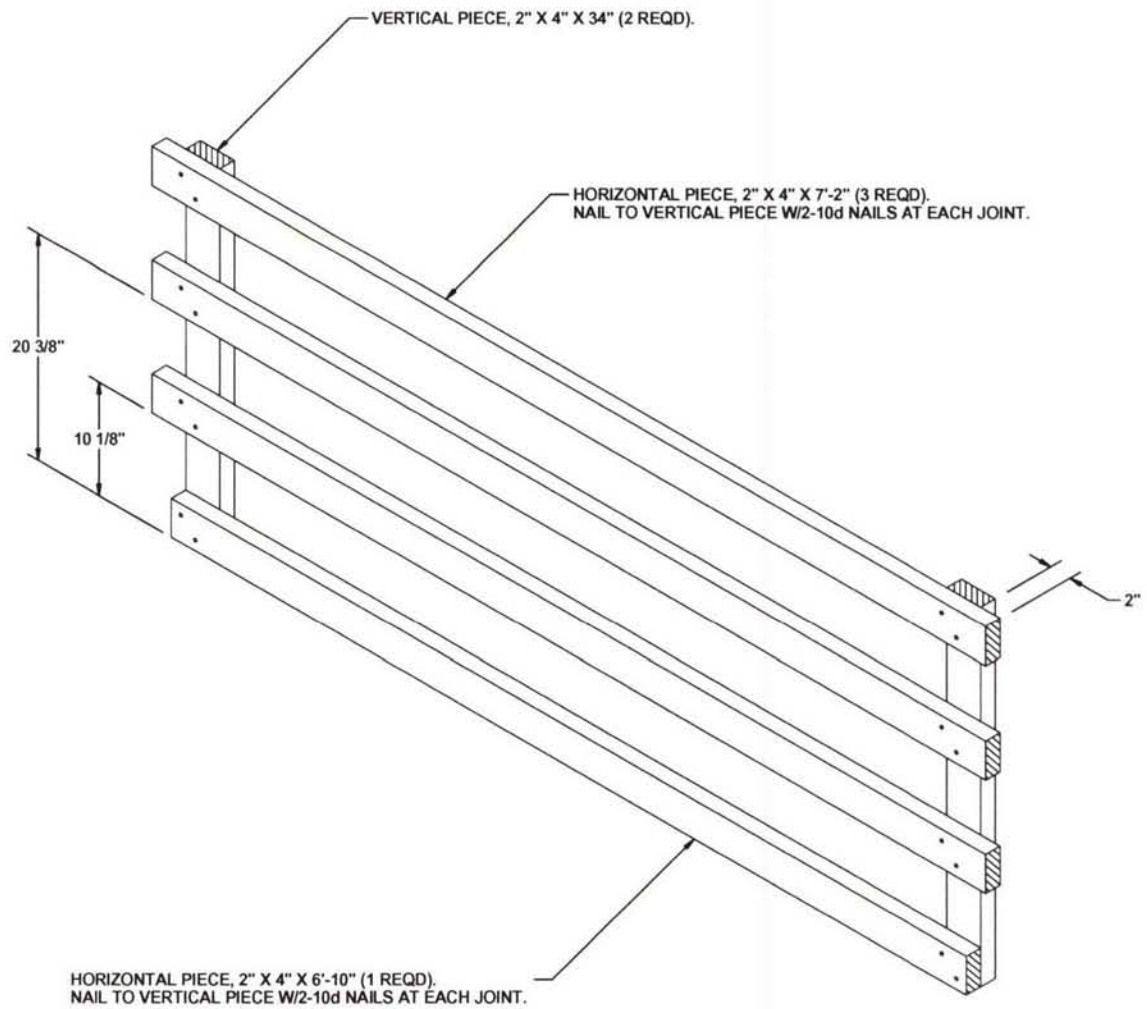
A557 PALLET UNIT

GROSS WEIGHT - - - - - 3,791 LBS (APPROX)
 CUBE - - - - - 47.2 CU FT (APPROX)

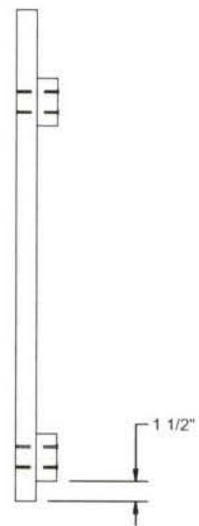
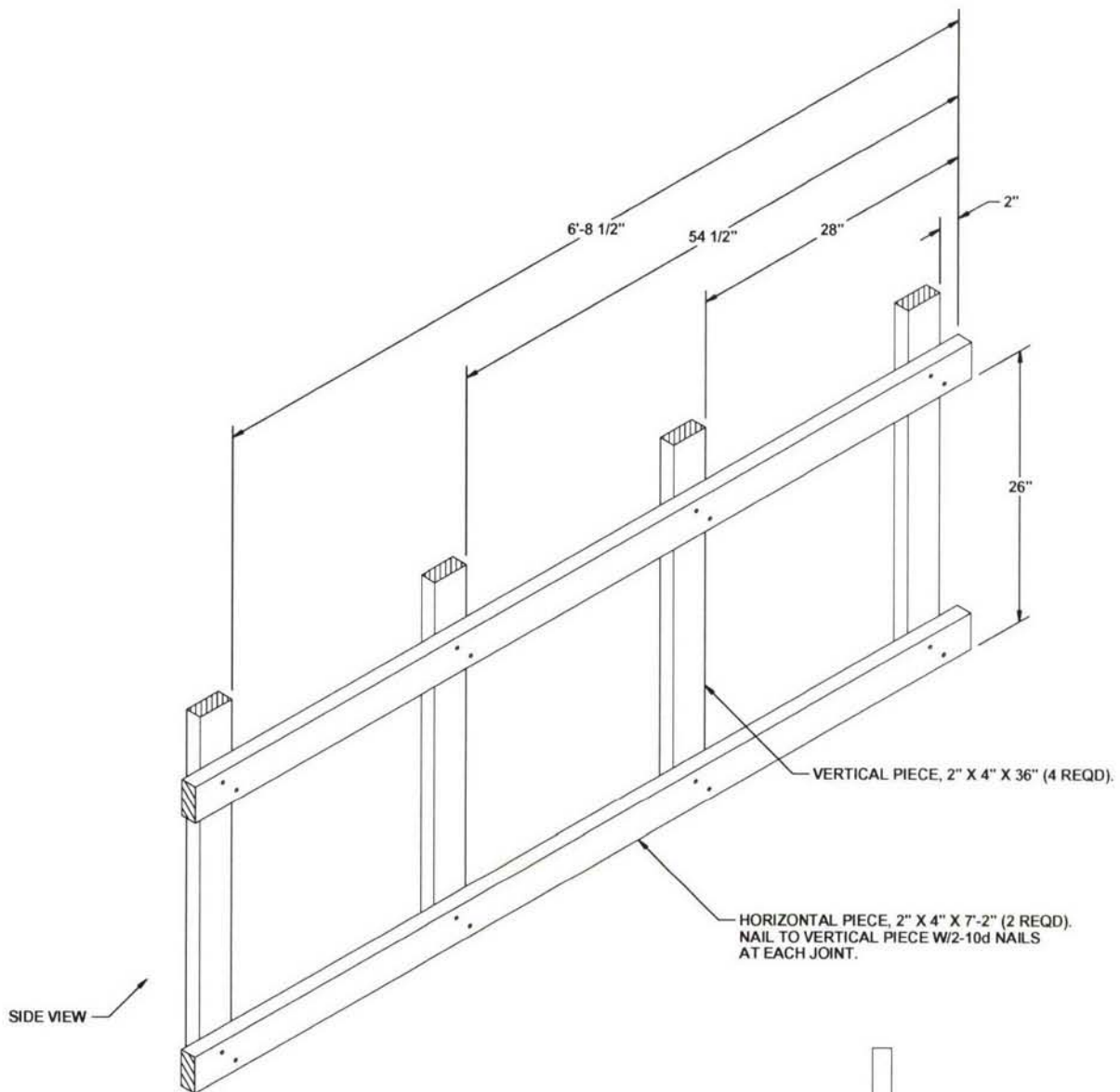


C445 PALLET UNIT

GROSS WEIGHT - - - - - 2,280 LBS (APPROX)
 CUBE - - - - - 40.3 CU FT (APPROX)

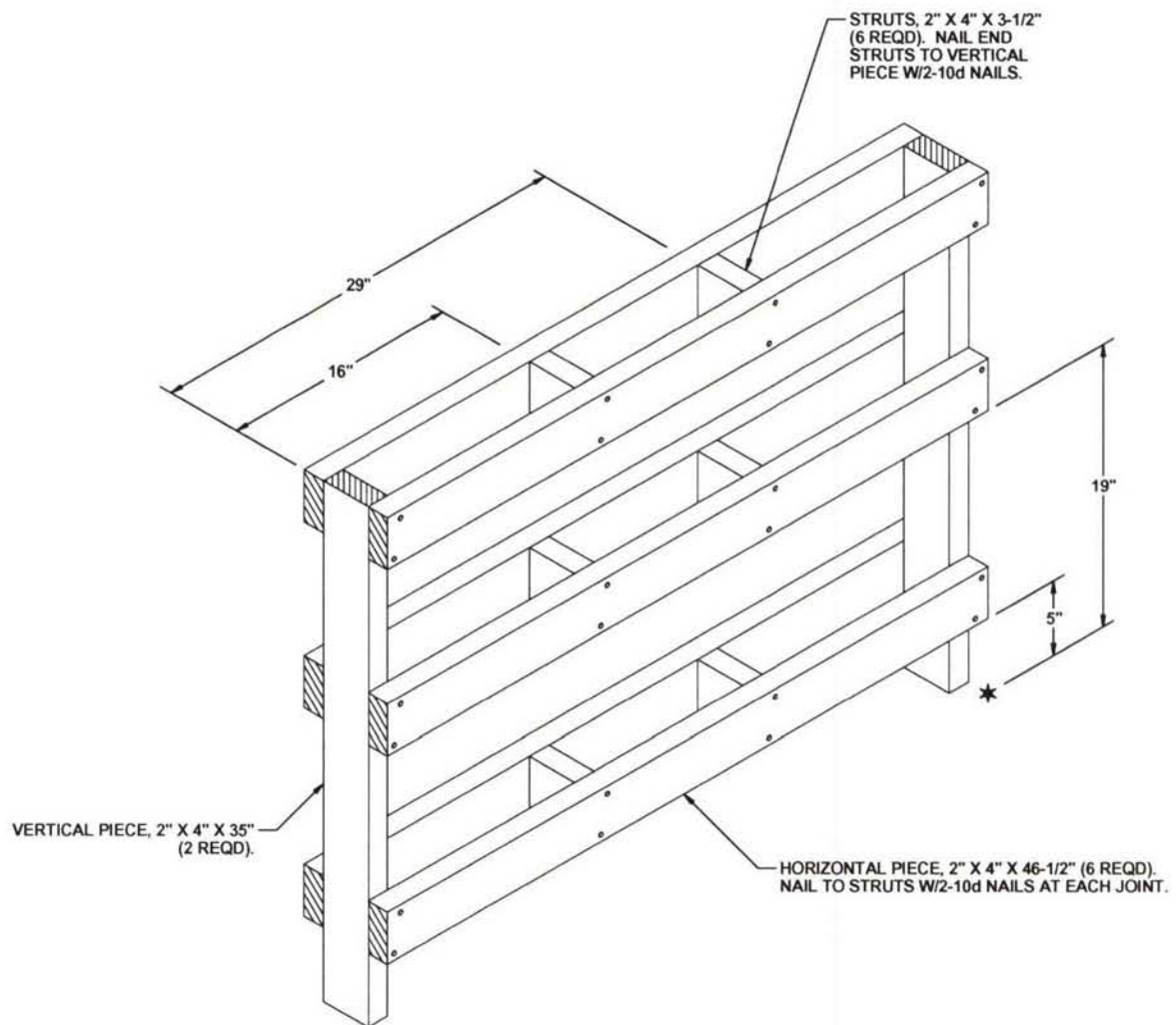


FORWARD BLOCKING ASSEMBLY

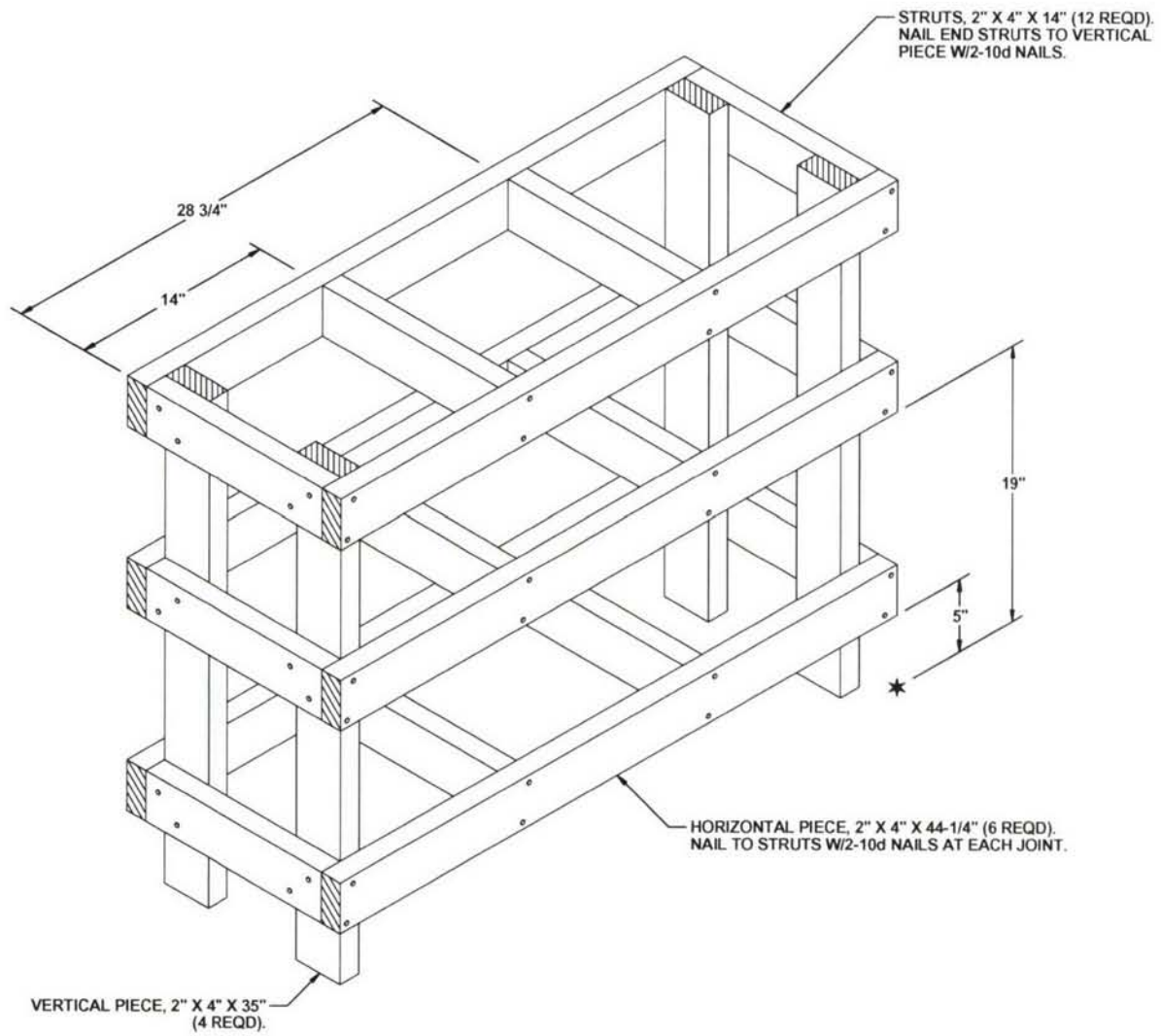


REAR BLOCKING ASSEMBLY

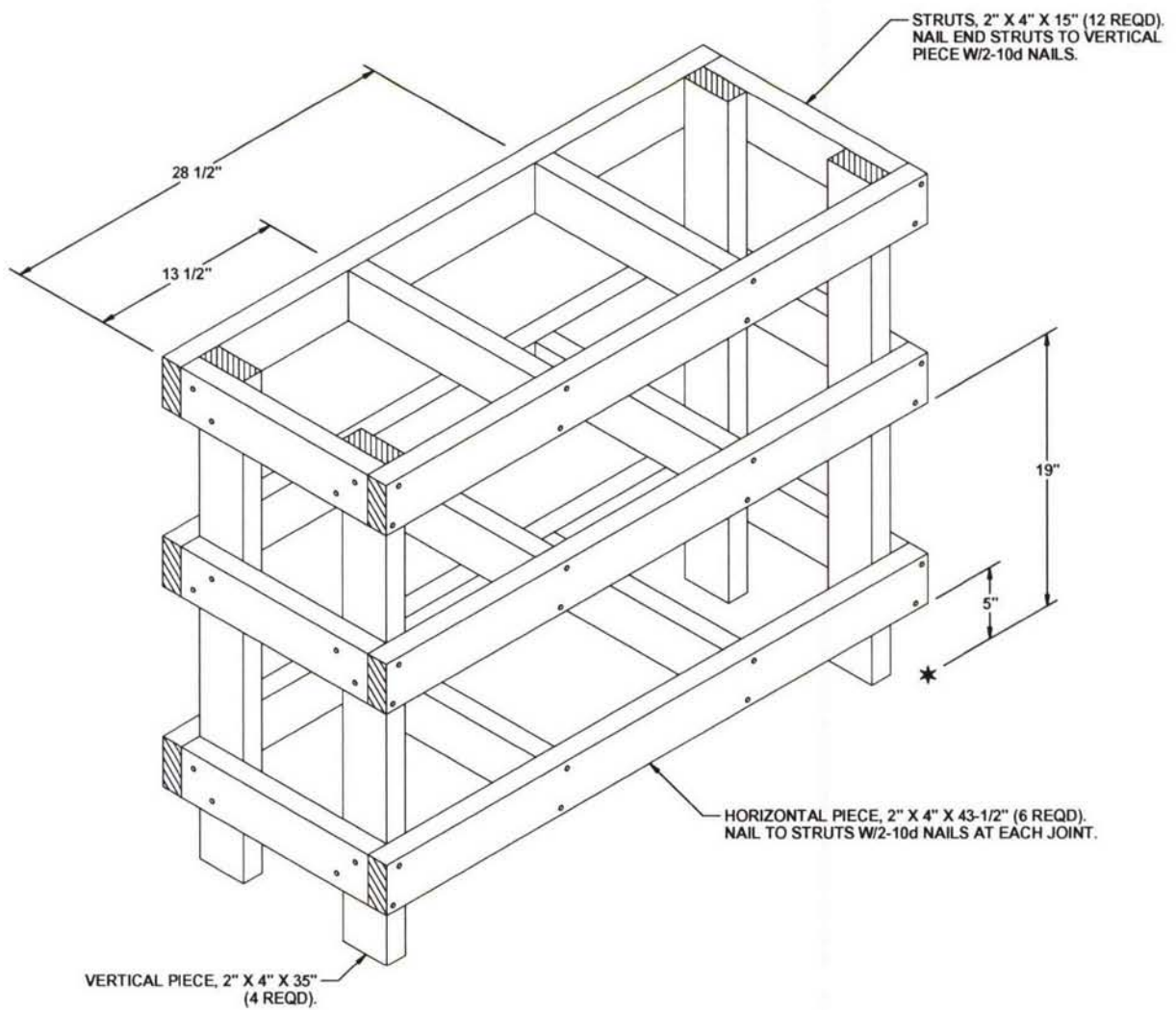
SIDE VIEW



C445 SIDE BLOCKING ASSEMBLY



A124 SIDE BLOCKING ASSEMBLY



A557 SIDE BLOCKING ASSEMBLY